L10: Entry 4 of 9 File: USPT May 24, 2005

DOCUMENT-IDENTIFIER: US 6898527 B2
** See image for Certificate of Correction **
TITLE: Parking assisting device

Abstract Text (1):
When a vehicle advances in parallel with a parking frame to reach an initial stop position, measurement of a distance to a parked vehicle is continuously performed by means of an ultrasonic sensor and a moving distance of the vehicle is simultaneously calculated using a signal from a wheel speed sensor. When actuating an in-line mode switch under a state where the vehicle stops in the initial stop position, a turning angle is calculated so as to enable appropriate in-line parking to the parking frame from an actual initial stop position, based on a deviation of the vehicle from a reference position for the initial stop measured by the ultrasonic sensor. Information on a driving operation that is necessary for back parking is provided to a driver via a speaker based on this turning angle and output from a yaw rate sensor.

Brief Summary Text (13):
The controller can provide via the guiding means to the driver the guiding information of: advancing the vehicle with a steering angle at the maximum from the initial stop position and stopping the vehicle in a back start position; moving the vehicle backward with the steering angle at the maximum in an opposite direction from the back start position and stopping the vehicle in a steering wheel cutting position; and moving the vehicle backward with the steering angle at the maximum in the opposite direction again from the steering wheel cutting position so as to cause the vehicle to reach a target parking space.

Brief Summary Text (16):
The controller can provide via the guiding means to the driver guiding information of: moving the vehicle backward with the steering angle at the maximum from the initial stop position and stopping the vehicle at the steering wheel cutting position; and moving the vehicle backward with the steering angle at the maximum in the opposite direction from the steering wheel cutting position so as to cause the vehicle to reach the target parking space.

Brief Summary Text (20):
Further, the controller may give a warning to the driver in a case where interference of the vehicle with the obstacle is predicted when the vehicle moves under a state of being held at a uniform steering angle.

Detailed Description Text (4):
FIG. 1 shows a construction of a parking assisting device in accordance with Embodiment 1 of the present invention. Connected to a controller 1 are: a yaw rate sensor 2 for detecting an angular speed in a direction of a yaw angle of a vehicle; a switch module 5 constituted by an in-parallel mode switch 3 for informing the controller 1 that a vehicle is parked in parallel; and an in-line mode switch 4 for informing the controller 1 that the vehicle is parked in line. Further, a speaker 6 for guiding driver information on a driving operation is connected with the controller 1.

Detailed Description Text (8):
In the ROM, there is stored data on a minimum turning radius Rc for a case where the vehicle turns with a steering wheel of the vehicle steered at maximum. At the same time, the control program for performing parking assistance upon the in-parallel parking and the in-line parking of the vehicle is stored in the ROM. The CPU operates based on the control program stored in the ROM. The controller 1 calculates a yaw angle of the vehicle from the angular speed of the vehicle inputted from the yaw rate sensor 2, calculates a turning angle of the vehicle and outputs information on an operation method and operation timing in each step during the parking operation to the speaker

6..

Detailed Description Text (9):
Here, what kind of track the parking assisting device of this embodiment causes the vehicle to draw to assist in-line parking will be described with reference to FIG. 2.

Detailed Description Text (11):
It is assumed that the vehicle 10 in a vehicle position J1 advances while turning at the radius Rc with a steering angle of the steering wheel at the maximum rightward; when the vehicle 10 reaches a vehicle position K1, the vehicle 10 moves backward while turning at the radius Rc with the steering angle at the maximum leftward; and, when the vehicle reaches a vehicle position L1, the vehicle 10 moves backward while turning at the radius Rc with the steering angle at the maximum rightward to appropriately be parked in the vehicle position M1 within the parking frame T.

Detailed Description Text (14):
The vehicle 10 in the vehicle position J1 advances to the vehicle position K1 while turning at the radius Rc with the steering angle of the steering wheel at the maximum rightward. In this case, a turning center is assumed to be C3 and a turning angle is assumed to be .beta.. In addition, the vehicle 10 in the vehicle position K1 moves backward to the vehicle position L1 while turning at the radius Rc with the steering angle at the maximum leftward. In this case, a turning center is assumed to be C4 and a turning angle is assumed to be .delta.. Moreover, the steering wheel is cut in the opposite direction in the vehicle position L1 and the vehicle 1 moves backward to the vehicle position M1 while turning at the minimum turning radius Rc with the steering angle at the maximum rightward. In this case, a turning center is assumed to be C5 and a turning angle is assumed to be .alpha..

Detailed Description Text (30):
The controller 1 sets the initial stop position as a position where the yaw angle of the vehicle is zero degree and simultaneously activates a program for in-line parking based on the operation of the in-line mode switch 4. The driver steers the steering wheel of the vehicle 10 to the maximum rightward to bring it to a fully cut state and advances the vehicle 10 in that state. The controller 1 calculates the yaw angle of the vehicle from the angular speed of the vehicle 10 inputted from the yaw rate sensor 2 and compares this yaw angle with the value of the calculated turning angle .beta.. As the vehicle 10 approaches the vehicle position K1, which is a back start position, from the initial stop position, the controller 1 informs the driver of approach information notifying that the vehicle has approached the vehicle position K1 and arrival information notifying that the vehicle has reached the vehicle position K1 based on the difference between the yaw angle and the calculated turning angle .beta. via the speaker 6.

Detailed Description Text (42):
A parking assisting device according to Embodiment 3 has the same construction as the parking assisting device of Embodiment 1 shown in FIG. 1. However, the parking assisting device according to this embodiment is a device provided not for stopping the vehicle in the reference position for the initial stop set in advance, but for guiding the driver an appropriate initial stop position that is calculated by the controller 1 based on a distance x to an obstacle on a side of the vehicle measured by the ultrasonic sensor 7. Further, guiding information is provided to the driver, in which: the vehicle moves backward by bringing the steering angle to the maximum from the initial stop position and the vehicle stops in a steering wheel cutting position; and the vehicle moves backward by bringing the steering angle to the maximum in the opposite direction from the steering wheel cutting position, whereby the vehicle reaches the target parking space.

Detailed Description Text (56):
The controller 1 monitors a moving distance of the vehicle 10 calculated using a signal from the wheel speed sensor 8. When the vehicle 10 has advanced by the forward distance D from a point where the ultrasonic sensor 7 reaches the rear end position of the parked vehicle 20, specific stop sound is emitted for the driver via the speaker 6. The driver stops the vehicle 10 upon hearing this stop sound. As a result, the vehicle 10 stops in the suitable initial stop position P1. In this case, the controller 1 resets a yaw angle of the vehicle 10 obtained by the yaw rate sensor 2.

Detailed Description Text (80):
Instead of the above-mentioned Embodiments 3 and 4 in which the distance to the parked vehicle 20 starts to be measured by actuating the in-line mode switch 4 while the vehicle 10 passes the side of the parking space, the initial stop position is calculated in Embodiment 5 by constantly

performing a measurement of a distance to the obstacle on the side of the vehicle by means of the ultrasonic sensor 7 and a measurement of a traveling distance of the vehicle by means of the wheel speed sensor 8, storing the distance to the obstacle on the side of the vehicle according to the traveling distance as a history, and using this history for the calculation.

Detailed Description Text (81):
The controller 1 constantly actuates the ultrasonic sensor 7 and the wheel speed sensor 8, and stores as a history the distance to the obstacle on the side of the vehicle according to the traveling distance for a past predetermined amount of time or predetermined traveling distance based on a signal inputted from these sensors.

Detailed Description Text (82):
The vehicle 10 stops on the side of the parked vehicle 20 by passing the side of the parking space in the same manner as it does in the initial stop position of Embodiments 3 and 4, for example, and the in-line mode switch 4 is actuated. In this manner, the controller 1 calculates an appropriate initial stop position for in-line parking in the parking space through the calculation method described in Embodiment 3 or 4, based on the history of the distance to the obstacle on the side of the vehicle according to the traveling distance for the predetermined amount of time or the predetermined traveling distance before the stop of the vehicle.

Detailed Description Text (84):
However, in a case where the initial stop position can not be calculated using only the history stored in the controller 1, the controller 1 further guides the driver to advance the vehicle straight forward or to move the vehicle straight backward via the speaker 6 and adds to the stored history a relationship between the traveling distance and the distance to the obstacle obtained during the above-mentioned operation, to thereby calculate the initial stop position. Thereafter, the controller 1 guides the driver to cause the vehicle to reach the initial stop position by advancing the vehicle straight forward or moving the vehicle straight backward via the speaker 6.

Detailed Description Text (93):
Note that, in Embodiments 1 to 6 described above, it is possible to constitute the device so as to give a warning to the driver via the speaker 6 in a case where it is impossible to calculate the turning angle that is applicable to the parking operation due to a large deviation and in a case where interference of the vehicle 10 with the obstacle such as the parked vehicle 20 upon in-line parking is predicted when turning the vehicle 10 at the turning angle obtained based on the steering angle that is held at the maximum. In this manner, it is possible to prevent the vehicle 10 from interfering with the obstacle, according to the turning angle that is calculated by considering a positional deviation of the initial stop position.

Detailed Description Text (94):
Further, in Embodiments 1 to 6, the yaw rate sensor is used as yaw angle detecting means. However, the means for detecting the yaw angle may also include a method using a position gyroscope or a method for detecting the yaw angle from a difference in rotation obtained by rotation sensors that are mounted to left and right wheels, respectively. Further, a method using a terrestrial magnetism sensor or a GPS system may also be used.

CLAIMS:

3. A parking assisting device according to claim 2, wherein the controller provides via the guiding means to the driver guiding information of: moving the vehicle backward with the steering angle at the maximum from the initial stop position and stopping the vehicle at the steering wheel cutting position; and moving the vehicle backward with the steering angle at the maximum in the opposite direction from the steering wheel cutting position so as to cause the vehicle to reach the target parking space.

9. A parking assisting device according to claim 1, wherein the yaw angle detecting mean is a yaw rate sensor.

13. A parking assisting device according to claim 12, wherein the controller provides via the guiding means to the driver the guiding information of: advancing the vehicle with a steering angle at the maximum from the initial stop position and stopping the vehicle in a back start position; moving the vehicle backward with the steering angle at the maximum in an opposite direction from the back start position and stopping the vehicle in a steering wheel cutting position; and moving the vehicle backward with the steering angle at the maximum in the opposite

direction again from the steering wheel cutting position so as to cause the vehicle to reach a target parking space.

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L10: Entry 5 of 9 File: USPT Mar 9, 2004

DOCUMENT-IDENTIFIER: US 6704653 B2
** See image for Certificate of Correction **
TITLE: Vehicle backing support apparatus

Abstract Text (1):
An object of the present invention is to provide a vehicle backward movement assisting apparatus during parking, in which a steering assisting guide display is performed so that a driver can easily comprehend a steering rate and time frame, a steering amount or a backward movement amount in parking a vehicle. When a vehicle starts a turn, a detecting means of a rotation speed difference between a right wheel and a left wheel detects a rotation speed difference between a right wheel and a left wheel. When the difference becomes the predetermined value or larger, it is recognized that the vehicle starts the turn. The angle speed, which is detected by a yaw rate sensor since the start of the turn, is added as a yaw angle. Then, the vehicle is stopped and a shift lever is operated so as to be set to a backward movement position, whereby the yaw angle at this time is detected as the turn angle since the time of starting the turn. An image processor displays a parallel parking guide line and a vehicle space mark so as to be inclined on the screen of a monitor based on the turn angle.

Brief Summary Text (5):
Conventionally, there has been proposed an apparatus, which displays the rear view of a vehicle on a monitor screen when a target place becomes out of sight for a driver due to a blind spot of the vehicle during a backward movement of the vehicle. For example, Japanese Patent Publication No. 2-36417 discloses a vehicle rear monitor apparatus comprising a television camera for picking up an image of the rear of a vehicle, a monitor television for displaying the image picked up by the television camera, a sensor for outputting an information signal related to a steering angle of a wheel, and a circuit for generating a marker signal in accordance with the information signal from the sensor and superimposedly displaying a marker on a television screen. In this apparatus, data on the wheel steering angle and data on marker positions along the direction in which the vehicle moves backward, which corresponds to the steering angle, are stored in a ROM. A predicted backward movement locus of the vehicle in accordance with the steering angle at that time is displayed on the television screen as a series of markers superimposed on the image picked up by the television camera.

Brief Summary Text (6):
According to this apparatus, when the vehicle moves backward, the rear view of a road condition, etc. and the predicted backward movement locus of the vehicle in accordance with the steering angle are displayed on the screen of the monitor television, so that the driver is capable of moving the vehicle backward by operating the steering wheel while the driver watches the television screen without turning the driver's head backward.

Brief Summary Text (8):
When performing parallel parking, for example, the vehicle is stopped in an inclined state with respect to a parking space and advanced into the parking space at an appropriate steering angle. Further, the steering wheel is returned in the reverse direction to guide the vehicle to a target parking position. However, in the conventional rear monitor apparatus, there is a problem in that when the driver looks only the rear view and the predicted backward movement locus of the vehicle on the television screen, it is difficult for the driver to determine what degree of steering angle the vehicle is to be advanced into the parking space at and where the steering wheel is to be returned, whereby parallel parking can not be sufficiently assisted.

Brief Summary Text (14):
The means for recognizing the start of a turn to a vehicle may be preferably composed of: means for detecting the rotation speed difference between a right wheel and a left wheel, a vehicle

speed sensor and a steering angle sensor, or a dedicated button. The means for detecting a turn angle may be preferably composed of: a yaw rate sensor, the steering angle sensor and a travel distance sensor, or a geomagnetism sensor. The means for indicating an acquisition of a turn angle may be preferably composed of a shift lever or a dedicated button.

Brief Summary Text (15):
The guide display is one for parallel parking may include: a parallel parking guide line displayed on the monitor screen in accordance with the turn angle detected by the means for detecting a turn angle; a vehicle space mark movingly displayed along on the parallel parking guide line on the monitor screen in accordance with the steering angle of the steering wheel; and an eye mark which is fixedly displayed at a predetermined position of the monitor screen and guides a return point of the steering wheel.

Brief Summary Text (16):
A vehicle backward movement assisting apparatus during parallel parking operation according to claim 6 of the present invention comprises: a camera for picking up the rear view of a vehicle; a monitor disposed at a driver's seat; a steering angle sensor for detecting a steering angle of a steering wheel; means for controlling a display, for displaying the image by the camera on the monitor while the vehicle being moved backward, and for superimposedly displaying on the screen of the monitor a guide display for assisting the vehicle drive during parking operation; and a first switch and a second switch which are disposed at the driver's seat of the vehicle, and by which the moving guide display on the screen of the monitor is moved in parallel and rotated, respectively, characterized in that: the moving guide display includes a parallel parking guide line and a vehicle space mark displayed so as to be moved along on the parallel parking guide line in accordance with the steering angle of the steering wheel detected by the steering angle sensor; and the fixed guide display includes an eye mark, which is fixedly displayed at the predetermined position of the screen of the monitor and which guides a return point of the steering wheel; and the means for controlling a display learns and stores the past rotation angle of the moving guide display made by the second switch and represents the moving guide display on the screen of the monitor at the stored rotation angle.

Brief Summary Text (18):
A vehicle backward movement assisting apparatus during parallel parking operation according to claim 7 of the present invention, in the apparatus according to claim 6, comprises the steps of: operating the second switch in the stop position of a vehicle to adjust the inclination of a parallel parking guide line and the inclination of a vehicle space mark to a target regarding a parking space on the monitor screen; operating the first switch to superimpose the parallel parking guide line on the target regarding the parking space on the monitor screen; returning a steering wheel for superimposing the vehicle space mark on the parking space; moving the vehicle backward while retaining the steering wheel at the position; stopping the vehicle at the position where the eye mark is superimposed on the parking space; moving the vehicle backward during a static turn so that the steering angle becomes maximum in a reverse direction; and appropriately performing parallel parking of the vehicle at the parking space.

Brief Summary Text (19):
In the apparatus, at the stop position of the vehicle, the second switch is operated until the inclination of the parallel parking guide line and the inclination of the vehicle space mark are adjusted to the target regarding the parking space. Then, the first switch is operated until the parallel parking guide line is superimposed on the target regarding the parking space. Further, the steering wheel is returned to where the vehicle space mark is superimposed on the parking space, and the vehicle is moved backward while holding the steering wheel in the state. When the eye mark is superimposed on the target point, next, the position is recognized to be a return point of the steering wheel, resulting in stopping the vehicle. When the vehicle is moved backward during a static turn so that the steering angle becomes maximum in a reverse direction, the vehicle is appropriately parked in parallel at the parking space.

Brief Summary Text (22):
In a vehicle backward movement assisting apparatus during parallel parking operation according to claim 9, in the apparatus according to claim 6 or 7, the means for controlling a display represents the moving guide display and the fixed guide display used for one of a right parallel parking and a left parallel parking with a high priority on the monitor screen, thereafter the means judges whether the direction of parallel parking is a right one or a left one, based on the steering angle detected by the steering angle sensor, and further in the case where the parallel parking is performed in a direction different from that in case of the moving guide display and

the fixed guide display displayed with a higher priority, the moving guide display and the fixed guide display of the other direction are displayed on the monitor screen.

Brief Summary Text (23):
In the apparatus, first, the moving guide display and the fixed guide display used for one of the right parallel parking and the left parallel parking are displayed with a high priority on the monitor screen. Thereafter, whether the direction of parallel parking is a right one or a left one is judged based on the value detected by the steering angle sensor. In the case where the parallel parking is performed in a direction different from that in case of the moving guide display and the fixed guide display displayed with a higher priority, the apparatus changes to the moving guide display and the fixed guide display of the other direction are displayed on the monitor screen.

Brief Summary Text (24):
A vehicle backward movement assisting apparatus during parallel parking operation according to claim 10, in the apparatus according to claim 6 or 7, comprises a yaw rate sensor for detecting the yaw rate of a vehicle, in which the means for controlling a display judges whether the direction of parallel parking is a right one or a left one in accordance with the angle change of a vehicle in a predetermined time required for stopping for performing parallel parking, based on the yaw rate detected by the yaw rate sensor, and the moving guide display and the fixed guide display of parallel parking in the judged direction are displayed on the monitor screen.

Brief Summary Text (25):
In the apparatus, whether the direction of parallel parking is a right one or a left one is judged in accordance with the angle change of a vehicle in the predetermined time required for stopping the vehicle for performing parallel parking, based on the yaw rate detected by the yaw rate sensor. Then the moving guide display and the fixed guide display of parallel parking in the judged direction are displayed on the monitor screen.

Drawing Description Text (23):
FIG. 22 is a block diagram showing a structure of a vehicle backward movement assisting apparatus according to Embodiment 2, in which means for recognizing a start of turn is composed of a vehicle speed sensor and a steering angle sensor.

Drawing Description Text (25):
FIG. 24 is block diagram showing a structure of a vehicle backward movement assisting apparatus according to Embodiment 3, in which means for detecting a turn angle is composed of a steering angle sensor and a travel distance sensor.

Detailed Description Text (5):
FIG. 2 shows the structure of a vehicle backward movement assisting apparatus during parallel parking operation according to Embodiment 1 of the present invention. The camera 2 is connected to an image processor 8. The image processor 8 is connected to the monitor 4 via a monitoring controller 9. The vehicle 1 is provided with a rear position switch 10 for detecting whether the shift lever 5 is changed to the backward movement position. A steering angle sensor 11 for detecting a steering angle .theta. of the steering wheel 7 is installed to a steering shaft of the steering wheel 7. Also, at the driver's seat, a seesaw switch 12 to be a parallel parking guide line moving switch employed for moving a parallel parking guide line described below on the monitor 4 is disposed. The rear position switch 10, the steering angle sensor 11 and the seesaw switch 12 are respectively connected to the image processor 8.

Detailed Description Text (6):
In addition, the image processor 8 is connected to a yaw rate sensor 118 as a turn angle detecting means. The yaw rate sensor 118 is connected to the shift lever 5 functioning even as an indicating means of a turn angle acquisition which indicates the timing for detecting the turn angle of a vehicle, and a detecting means of a rotation speed difference between a right wheel and a left wheel 120 for recognizing the start of turn of a vehicle. Note that the detecting means of a rotation speed difference between a right wheel and a left wheel 120 can be composed of, for example, two rotation speed sensors respectively installed on the left wheel and the right wheel.

Detailed Description Text (10):
Further, the CPU 13 displays and moves the vehicle space mark 32 along on one of the parallel parking guide lines 30 and 31 of the screen 19 of the monitor 4 in accordance with the steering angle .theta. of the steering wheel 7 at that time based on the output signal of the steering

angle sensor 11. For example, when the steering wheel 7 is returned leftward, as shown in FIG. 3C, the vehicle space mark 32 is moved leftward along on the parallel parking guide line 30 on the left side of the screen. When the steering wheel 7 is returned rightward, the vehicle space mark 32 is moved in a right direction along on the parallel parking guide line 31 on the right side of the screen.

Detailed Description Text (12):
Next, a method for drawing the parallel parking guide lines 30 and 31 and the vehicle space mark 32 will be described with reference to FIG. 4. As shown in FIG. 4, when the center of a rear accelerator of the vehicle 1 is assumed to be the origin in the state that the vehicle is appropriately parked at the parking space PS, the Y-axis is taken in a direction of backward movement of the vehicle 1 and in parallel with a road. The X-axis is taken in a direction perpendicular to the Y-axis. Also, it is assumed that the widthwise corner of the parking space PS is a target point T, and its coordinates are T (W/2, a), where W indicates a vehicle width and a indicates a rear overhang. The vehicle 1 at a vehicle position M moves backward while being turned at an angle .alpha. with a radius of Rm with a point C1 as a center (first turn), and when the vehicle reaches a vehicle position P, the steering wheel 7 is turned in a reverse direction so that the steering angle becomes maximum. In this state, the vehicle 1 is moved backward with a radius of Rc with a point C2 as a center (second turn), to thereby appropriately park the vehicle at the parking space PS.

Detailed Description Text (15):
Assuming that K1, K2 and K3 are known coefficients, the radius Rm of the first turn from the vehicle position M to the vehicle position P is obtained as follows through the steering angle .theta. of the steering wheel 7 at this time.

Detailed Description Text (18):
The vehicle space mark 32 can be drawn at the position corresponding to the steering angle .theta. with the point Tm (Tmx, Tmy) as the rear end.

Detailed Description Text (19):
On the screen 19, the steering angle .theta. is changed by operating the steering wheel 7, as a result of which the vehicle space mark 32 is moved along the parallel parking guide lines 30 and 31 and then superimposed on the parking space PS. Thus, an appropriate steering angle .theta. corresponding to the vehicle position M can be obtained.

Detailed Description Text (24):
Assuming that the steering angle of the first turn from the origin O to the vehicle position P is .beta., and in the case where it is assumed that the vehicle 1 is moved to the position in parallel with the parking space PS while keeping the turn radius Rm of the first turn, the steering angle of the first turn is .alpha., the following relations are obtained.

Detailed Description Text (28):
Next, an operation of the vehicle backward movement assisting apparatus during parallel parking will be described. First, as shown in FIG. 6, a vehicle moves straight ahead along a line CL in parallel with the target parking space PS and reaches a vehicle position A. During the above operation, the yaw rate sensor 118 keeps detecting the angle speed of the vehicle until the vehicle reaches a vehicle position B. Until the vehicle reaches the vehicle position A while advancing along the line CL, the vehicle moves straight ahead. Therefore, the right wheel and the left wheel of the vehicle rotate at the same rotation speed, and there is not nearly a difference of the rotation speed detected by the detecting means of a rotation speed difference between a right wheel and a left wheel 120, whereby it is recognized that the vehicle moves straight ahead. Then, while the vehicle moves straight ahead, the angle speed in a yaw direction of the vehicle detected by the yaw rate sensor 118 is kept being canceled.

Detailed Description Text (29):
Then, a driver gives an appropriate steering angle around where the vehicle passes the vehicle position A on the side of the target parking space PS, and the vehicle is moved to the vehicle position B inclining by the turn angle .phi. from the line CL in parallel with the target parking space PS, to thereby be stopped. When the vehicle starts to be turned towards the position B, the detecting means of a rotation speed difference between a right wheel and a left wheel 120 detects the difference of the rotation speed between the right wheel and the left wheel. The above difference of the rotation speed becomes the predetermined value or more, whereby it is recognized that the vehicle starts to be turned. The steering angle speed of the vehicle, which is detected

by the yaw rate sensor from the turn start, is added as a yaw angle.

Detailed Description Text (32):
Here, when the steering wheel 7 is returned to the left, the vehicle space mark 32 gradually moves leftward along the parallel parking guide line 30 in accordance with the steering amount of the steering wheel 7. Then, as shown in FIG. 3C, when the vehicle space mark 32 is superimposed on the parking space PS, the vehicle 1 is moved backward while the steering angle .theta. of the steering wheel 7 is retained. Thus, the vehicle 1 is turned with a radius of Rm. At that time, the driver can move the vehicle 1 backward while ensuring the safety of the periphery of the vehicle with his eyes being averted from the screen 19.

Detailed Description Text (34):
Next, the steering angle of the steering wheel 7 is made maximum in the reverse direction during a static turn, and in this state, the vehicle 1 is moved backward. At this time, the driver can move the vehicle 1 backward while ensuring the safety of the periphery of the vehicle 1 with his eyes being averted from the screen 19. As a result, the vehicle 1 appropriately enters the parking space PS. When the driver recognizes a gap between the vehicle and the rear, or when the side portion of the vehicle 1 becomes in parallel with a road side, the vehicle 1 is stopped and the lateral parking is completed.

Detailed Description Text (38):
In Embodiment 1, the detecting means of a rotation speed difference between a right wheel and a left wheel 120 is employed as means for recognizing the start of the turn of the vehicle. However, the present invention is not limited to this. For example, as shown in FIG. 22, the recognizing means may be comprised of a vehicle speed sensor 300 and the steering angle sensor 11. In this case, when the vehicle speed sensor detects a vehicle speed faster than a constant value and the steering angle sensor detects a steering angle larger than a predetermined angle so as to turn the vehicle, it can be recognized that the vehicle turn is started out of the state of the vehicle being moved straight. Also, as another modified embodiment, as shown in FIG. 23, instead of the detecting means of the rotation speed difference between a right wheel and a left wheel 120, a dedicated button 301 may also be employed. That is, the driver presses the dedicated button at the vehicle position A in FIG. 6, whereby it may be recognized that the vehicle turn is started.

Detailed Description Text (40):
In Embodiment 1, the yaw rate sensor 118 is employed as the turn angle detecting means for detecting the turn angle of the vehicle from the turn start. However, the present invention is not limited to this. For example, as shown in FIG. 24, the detecting means may be composed of the steering angle sensor 11 and a travel distance sensor 302. That is, the turn radius of the vehicle is obtained based on the steering angle detected by the steering angle sensor 11 and the travel distance is obtained by the travel distance sensor. Thus, the turn angle of the vehicle can be detected based on the information of the travel amount with the obtained turn radius. Also, as another modified embodiment, as shown in FIG. 25, instead of the yaw rate sensor 118, a geomagnetism sensor 303 can also be employed.

Detailed Description Text (47):
FIG. 9 shows the structure of the vehicle backward movement assisting apparatus during parallel parking operation according to Embodiment 6 of the present invention. The camera 202 is connected to an image processor 208. The image processor 208 is connected to the monitor 204 via a monitoring controller 209. A steering angle sensor 210 for detecting the steering angle .theta. of the steering wheel 207 is installed to the steering shaft of the steering wheel 207 of the vehicle 201. Also, at the driver's seat, a mode operation button 211 for performing operations by selecting various kinds of modes, a seesaw switch 212 to be a first switch and a seesaw switch 213 to be a second switch, by which a moving guide display described later is moved in parallel and rotated on the monitor 204, are disposed. Each of the steering angle sensor 210, the mode operation button 211, the seesaw switch 212 and the seesaw switch 213 is connected to the image processor 208.

Detailed Description Text (54):
Further, the CPU 214 causes all of the vehicle space mark 220, the parallel parking guide lines 221 to 224 and the auxiliary lines 225 to 228 to move, upon display thereof along the parallel parking guide lines 221 and 223 or the parallel parking guide lines 222 and 224, which is performed in accordance with the steering angle .theta. of the steering wheel 207 at that time, based on the output signal of the steering angle sensor 201. For example, when the steering wheel 207 is turned to the left, as shown in FIG. 10D, the vehicle space mark 220, the parallel parking

guide lines 221 to 224 and the auxiliary lines 225 to 228 are moved in a left direction along the parallel parking guide lines 221 and 223 indicated in the left side of the screen.

Detailed Description Text (60):
Here, as shown in FIG. 10D, the driver operates the steering wheel 207 so that the vehicle space mark 220 is superimposed on the parking space PS, and thereafter the vehicle 201 is moved backwards while retaining the steering angle .theta. of the steering wheel 207. Here, the CPU 214 ends the display of the vehicle space mark 220, the parallel parking guide lines 221 to 224 and the auxiliary lines 225 to 228, and instead as shown in FIG. 10E, an eye mark 229 is fixedly displayed so as to be superimposed on the image picked up by the camera 202. At the position where the parking space PS is superimposed on the eye mark 229, the driver judges that the vehicle reaches the vehicle position P and stops the vehicle. Further, the steering angle of the steering wheel 207 is made maximum in the reverse direction during a static turn, and in this state, the vehicle 1 is moved backward, to thereby complete parallel parking.

Detailed Description Text (69):
In Embodiment 8, the image processor 208 judges the direction of parallel parking based on the steering angle detected by the steering angle sensor 210. The structure of the vehicle backward movement assisting apparatus is similar to that of Embodiment 1 shown in FIG. 9. Note that, the image processor 208 is equipped with a memory used for the left parallel parking and a memory for the right parallel parking.

Detailed Description Text (73):
At the following step S14, the CPU 214 judges whether the steering angle detected by the steering angle sensor 210 is greater than 45.degree. in a right direction. Here, when a driver tries to start the left parallel parking, the driver does not turn the steering wheel 207 but starts the operation of the seesaw switch 213. Therefore, moving from step S14 to step S15, the CPU 214 displays the moving guide display for the left parallel parking as the moving guide display. When, in a manner similar to that in Embodiment 6, a series of the sequences of the left parallel parking is completed at step S16, the CPU 214 writes the inclination angle of the moving guide display in this sequence in the memory (not shown) used for the left parallel parking, and calculates and then stores the average value of the inclination angles of the past. This average value of the inclination angle is used in the next left parallel parking.

Detailed Description Text (74):
Also, when the driver tries to start the right parallel parking, after the moving guide display used for the left parallel parking is represented at step S13, the driver starts to return the steering wheel 207 to a right direction with the intention of performing the right parallel parking. Then, when the steering angle of the steering wheel 207 becomes greater than 45.degree. to a right direction, the CPU 214 judges the direction of parallel parking as the right one. At step S18, the past average inclination angle of the right parallel parking, which is stored in the memory (not shown) used for the right parallel parking, is read out. Then, the CPU 214 displays the vehicle space mark 220 for the right parallel parking and the parallel parking guide lines 221 to 214 on the screen of the monitor 204 in accordance with the inclination angle, which is thus read out, so as to be superimposed on the image picked up by the camera 202, as shown in FIG. 17B.

Detailed Description Text (77):
In Embodiment 8, the steering angle of the steering wheel 7, by which it is judged whether the direction of parallel parking is a right one or not, is not limited to 45.degree. in a right direction. The other value may be also applicable.

Detailed Description Text (79):
FIG. 18 shows the structure of the vehicle backward movement assisting apparatus during parallel parking operation according to Embodiment 9. The vehicle backward movement assisting apparatus, in the apparatus of Embodiment 6 shown in FIG. 9, is provided with a yaw rate sensor 231 at the vehicle 201. The yaw rate sensor 231 is connected to the image processor 208. Note that, the image processor 208 is equipped with a memory used for the left parallel parking and a memory for the right parallel parking.

Detailed Description Text (83):
The CPU 214 obtains the peak value of the yaw rate angle for a predetermined time period before stopping a vehicle during parallel parking operation, for example, until 10 seconds before stopping the vehicle, based on the yaw rate detected by the yaw rate sensor 231.

Detailed Description Text (88):
Additionally, at step S32, when the peak value of the yaw rate angle is -5.degree. or larger but +5.degree. or smaller, the direction of parallel parking cannot be judged. Therefore, the moving guide display such as shown in FIG. 14, which is represented upright with the inclination angle 0.degree. is displayed at step S39. At step S40, a series of the sequences of parallel parking is performed, to thereby complete the processing.

Detailed Description Text (91):
Also, the peak value of the yaw rate angle for judging whether the direction of parallel parking is a right one or a left one is not limited to +5.degree. and -5.degree.. The other value may be also applicable.

Detailed Description Text (92):
Note that, as shown in FIG. 21, when the vehicle 201 is equipped with a vehicle speed sensor 232 instead of the yaw rate sensor 231, and the angle changes of the vehicle 201 in the predetermined time required for stopping a vehicle during parallel parking operation is obtained from the steering angle detected by the steering angle sensor 210 and the vehicle speed detected by the vehicle speed sensor 232, the judgment whether the direction of parallel parking is a right one or a left one can also be conducted. Further, when the vehicle 201 is equipped with a distance sensor, instead of the vehicle speed sensor 232, the judgment whether the direction of parallel parking is a right one or a left one can be conducted based on the angle changes of the vehicle 201.

Detailed Description Text (96):
According to the vehicle backward movement assisting apparatus according to claim 7, in the position where a vehicle is stopped, the second switch is operated so that the inclination of the parallel parking guide lines and the inclination of the vehicle space mark are made to match the target angle with respect to the parking space on the screen of the monitor, and thereafter the first switch is operated so that the parallel parking guide lines are superimposed on the target positions of the parking space, and the steering wheel is turned until the vehicle space mark is superimposed on the vehicle space. Then, the vehicle is moved backward while retaining the steering wheel in that state, and the vehicle is stopped at the position where the eye mark is superimposed on the target point, and then the vehicle is moved backward during a static turn by making the steering angle maximum in a reverse direction. With only the above operations, the parallel parking to the parking space can be completed.

Detailed Description Text (98):
According to the vehicle backward movement assisting apparatus according to claim 9, first the moving guide display and the fixed guide display used for either of the left parallel parking or the right parallel parking are displayed with a higher priority on the monitor screen, and thereafter the judgment whether the direction of parallel parking is a right one or a left one is performed based on the value detected by the steering angle sensor. In the case where the direction of parallel parking thus judged is different from that in the moving guide display and the fixed guide display which are first displayed, the moving guide display and the fixed guide display are changed to one used for the other direction. Therefore, by only steering the steering wheel, the judgment whether the direction of parallel parking is a right one or a left one is automatically performed and each of the left parallel parking and the right parallel parking is learned, whereby it becomes easier to perform parallel parking in both cases.

Detailed Description Text (99):
According to the vehicle backward movement assisting apparatus according to claim 10, the judgment whether the direction of parallel parking is a right one or a left one is performed based on the angle changes of a vehicle during a predetermined time before stopping the vehicle for parallel parking on the basis of the yaw rate detected by the yaw rate sensor. The moving guide display and the fixed guide display for the parallel parking in the judged direction are displayed on the screen of the monitor. Therefore, the judgment whether the direction of parallel parking is a right one or a left one is automatically performed, and each of the left parallel parking and the right parallel parking is learned, whereby it becomes easier to perform parallel parking in both cases.

CLAIMS:

2. A vehicle backward movement assisting apparatus according to claim 1, characterized in that the

recognizing means is composed of means for detecting the rotation speed difference between a right wheel and a left wheel, a vehicle speed sensor, a steering angle sensor or a dedicated button.

3. A vehicle backward movement assisting apparatus according to claim 1, characterized in that the means for detecting a turn angle is composed of a yaw rate sensor, a steering angle sensor, a travel distance sensor or a geomagnetism sensor.

5. A vehicle backward movement assisting apparatus during parking according to claim 1, characterized in that the guide display representing a display used for parallel parking includes: a parallel parking guide line displayed on the screen of the monitor in accordance with the detected turn angle; a vehicle space mark displayed so as to be moved along on the parallel parking guide line on the screen of the monitor in accordance with a steering angle of a steering wheel; and an eye mark which is displayed so as to be fixed at a predetermined position of the screen of the monitor, and which guides the turn point of the steering wheel.

6. A vehicle backward movement assisting apparatus during parallel parking, characterized by comprising: a camera for picking up the rear view of a vehicle; a monitor disposed at a driver's seat; a steering angle sensor for detecting a steering angle of a steering wheel; means for controlling a display, for displaying the image by the camera on the monitor while the vehicle is moving backward, and for superimposedly displaying on the screen of the monitor a guide display for assisting the vehicle drive during parking operation; and a first switch and a second switch which arc disposed at the driver's seat of the vehicle, and by which a moving guide display on the screen of the monitor is moved in parallel and rotated, respectively, characterized in that: the moving guide display includes a parallel parking guide line and a vehicle space mark displayed so as to be moved along on the parallel parking guide line in accordance with the steering angle of the steering wheel detected by the steering angle sensor; and a fixed guide display includes an eye mark, which is fixedly displayed at a predetermined position on the screen of the monitor and which guides a return point of the steering wheel; and the means for controlling a display learns and stores a past rotation angle of the moving guide display made by the second switch and represents the moving guide display on the screen of the monitor at the stored rotation angle.

7. A vehicle backward movement assisting apparatus during parallel parking according to claim 6, characterized in that: in a position where a vehicle is stopped, the second switch is operated so that an inclination of the parallel parking guide line and an inclination of the vehicle space mark are superimposed on a target regarding a parking space on the screen of the monitor; thereafter, the switch is operated so that the parallel parking guide line is superimposed on the target regarding the parking space on the screen of the monitor; the steering wheel is returned so that the vehicle space mark is superimposed on the parking space; the vehicle is moved backward while retaining the steering wheel at that position, and the vehicle is stopped at the position where the eye mark is superimposed on the parking space; and then the vehicle is moved backward during a static turn so that the steering angle of the steering wheel becomes maximum in a reverse direction, whereby the vehicle is appropriately parked in tandem at the parking space.

9. A vehicle backward movement assisting apparatus during parallel parking according to claim 6, comprising a yaw rate sensor for detecting the yaw rate of the vehicle, wherein the means for controlling a display judges whether a direction of parallel parking is a right one or a left one in accordance with angle changes of the vehicle, in a predetermined time required for stopping the vehicle for performing parallel parking, based on the yaw rate detected by the yaw rate sensor, and the moving guide display and the fixed guide display of parallel parking of a chosen direction are represented on the screen of the monitor.

10. A method for controlling the display of the vehicle backward movement assisting apparatus during parallel parking in the right and left directions, the vehicle backward assisting apparatus having a camera for picking up the rear view of a vehicle, a monitor disposed at a driver's seat, a steering angle sensor for detecting a steering angle of a steering wheel, means for controlling a display, for displaying the image by the camera on the monitor while the vehicle is moved backward and for superimposedly displaying on the monitor a moving guide display that moves in accordance with the steering angle of the steering wheel detected by the steering angle sensor and a fixed guide display, and a first switch and a second switch which are disposed at the driver's seat of the vehicle, and by which a moving guide display on the screen of the monitor is moved in parallel and rotated, respectively, characterized in that the moving guide display includes a parallel parking guide line and a vehicle space mark displayed so as to be moved along on the parallel parking guide line in accordance with the steering angle of the steering wheel detected by the steering angle sensor, and the fixed guide display includes an eye mark, which is fixedly

displayed at a predetermined position on the screen of the monitor and which guides a return point of the steering wheel, and the means for controlling a display learns and stores a past rotation angle of the moving guide display made by the second switch and represents the moving guide display on the screen of the monitor at the stored rotation angle, the method comprising: representing the moving guide display and the fixed guide display, on the monitor, for parallel parking in a preselected direction, the preselected direction being either the right direction or the left direction, the moving guide display and fixed display for the preselected direction being given a priority; thereafter judging whether the direction of parallel parking is in the right or the left direction, based on the steering angle detected by the steering angle sensor; and representing, on the monitor, the moving guide display and the fixed guide display for a direction which is opposite to the preselected direction being given a priority, when the direction judged by the above judging is different from the preselected direction being given a priority.

11. A vehicle backward movement assisting apparatus during parking comprising: a camera for picking up the rear view of a vehicle; a monitor disposed at the driver's seat; a recognizing means for recognizing a start of turn of the vehicle; a detecting means for detecting a turn angle of the vehicle after the start of turn; means for indicating an acquisition of a turn angle, said means also indicating a time for detecting the turn angle detected by the detecting means; and means for controlling the monitor to display an image from the camera, while the vehicle is moving backward, and to superimposedly display, on the monitor, a guide display based on the detected turn angle, for assisting the vehicle in a backward movement during parking, wherein the guide display assists the vehicle drive so that a travel locus of the vehicle, from a start of a parking operation to a completion of a parking operation, is a combination of a plurality of arcs having constant radii, circumscribing each other wherein an intersection point of two corresponding arcs, is positioned on a line segment that connects two corresponding centers of curvature of said two arcs, and the travel locus has at least one of said intersection point.

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L4	parking near4 assist	525	L4
L3	l1 and L2	1	L3
L2	automatic$ adj (steering adj angle)	30	L2
L1	parking adj assist	152	L1

END OF SEARCH HISTORY